

ALASKA STATE LEGISLATURE
HOUSE SPECIAL COMMITTEE ON OIL AND GAS

March 3, 2005

5:06 p.m.

MEMBERS PRESENT

Representative Vic Kohring, Chair
Representative Nancy Dahlstrom
Representative Lesil McGuire
Representative Norman Rokeberg
Representative Ralph Samuels
Representative Berta Gardner
Representative Beth Kerttula

MEMBERS ABSENT

All members present

COMMITTEE CALENDAR

OVERVIEW: BP VISCOUS OIL 101

- HEARD

PREVIOUS COMMITTEE ACTION

No previous action to record

WITNESS REGISTER

DON DUNHAM, Asset Manager
and North Slope Viscous Oil Strategy Lead
BP Exploration (Alaska) Inc.
Anchorage, Alaska
POSITION STATEMENT: Presented overview of viscous oil.

CHRIS WEST, Team Leader
Viscous Oil Technology
BP Exploration (Alaska) Inc.
Anchorage, Alaska
POSITION STATEMENT: Presented overview of viscous oil.

ACTION NARRATIVE

CHAIR VIC KOHRING called the House Special Committee on Oil and Gas meeting to order at [5:06:07 PM](#). Representatives Kohring,

Dahlstrom, McGuire, Rokeberg, and Gardner were present at the call to order. Representatives Kerttula and Samuels arrived as the meeting was in progress.

OVERVIEW: VISCOUS OIL

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CHAIR KOHRING announced that the only order of business would be an overview of viscous oil. He commented:

That's a ... very significant issue because it represents phenomenal potential as far as development and extraction of oil in the future. And we're hoping to move in the direction of getting that oil developed, at least to a degree. And as technology increases, we're able to access more and more of that oil.

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DON DUNHAM, Asset Manager and North Slope Viscous Oil Strategy Lead, BP Exploration (Alaska) Inc. (BP), presented an overview of viscous oil using slides and graphs, and he began with a brief outline of his presentation. He referred to a graph that showed BP's share of oil production over the life of the North Slope fields. He commented, "You'll notice that we see a 50-year future as a possibility. I see this as not only what's predictable but what's unpredictable, if we can solve a lot of things that we don't know how to do." He explained that the graph showed how over the years new oil fields had come online, but there was a decline in production, and at present the fields are "at a flattening point". He noted that there is viscous oil "that we actually think we know how to do" called "water-floodable".

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MR. DUNHAM commented that BP predicts there to be over five billion barrels [in reserves] "if we can actually solve all the problems that are out there, whether it be gas, whether it be viscous oil, whether it be extended field life from Prudhoe Bay and Kuparuk." He said that BP's strategy is to focus on managing the decline of the light oil fields, to transform the cost base, and bridge to gas sometime in the next decade.

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MR. DUNHAM pointed out that, of all the business units in BP, Alaska is the biggest slice of BP, which in turn is one of the biggest companies in the world. However, he said, the light oil is almost all optimized and has been developed. He referred to a graph that depicted, "the possibilities of things that either we think we know how to do, or they're ... not quite economic or they actually could be extensions in the future", as well as things that are uneconomic, like gas, which cannot be exported right now.

MR. DUNHAM, in response to Representative Gardner, clarified that a graph showed several different business units around the world and compared Alaska to those.

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MR. DUNHAM commented that his primary message was that there are a lot of undeveloped barrels of viscous oil and gas in Alaska that are tough to access. He explained that the heavier oil is at a shallower depth, and it's colder because it's closer to the permafrost. He noted that BP and ConocoPhillips Alaska, Inc. have major interests in many of the viscous oil areas on the North Slope, and most of it is in the Milne Point/Kuparuk area.

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MR. DUNHAM stated:

There are two major tranches of viscous oil in Alaska. One is West Sak/Schrader Bluff; they're the same formation, they just got named different things by different people. And then there's the Ugnu, which is even more shallow. There are in place something like 20-23 billion barrels in the ground. ... It won't all come out; it never will. The issue is how much can you get out. In a light oil field like a Prudhoe you might get 50-60 percent of it out, because it flows better, it's better rock, it's got more temperature. But in the viscous, right now, we have found the first part of the West Sak and Schrader [oil]; we've been able to get around 20 percent of it out. The other 80 percent would be left. On ... the rest of the West Sak/Schrader and the Ugnu, ... it's going to be zero because it's the challenge part, it's the part we've got to keep working for technology to find. ... And you'll never get all of the oil that's

in there because some of it just will not come out.
Viscous is not just as prolific as light.

MR. DUNHAM pointed out the "water-floodable area" on a map, where BP injects water to boost the pressure in the reservoir to get about 18-20 percent of the oil out of the ground. He also pointed out areas considered "nonwater-floodable" because BP does not know how to water-flood it and therefore it can't get a high recovery rate. He pointed out that in the western areas like Ugnu, the sands that hold the oil get close to the permafrost, whereas the sands are deeper in the eastern areas like Orion and Polaris. There is also a big temperature difference, he noted.

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CHAIR KOHRING asked what the overall known quantities of the heavy oil on the North Slope were, and how much of it is accessible right now.

CHRIS WEST, Team Leader, Viscous Oil Technology, BP Exploration (Alaska) Inc. replied that BP had identified about 23 billion barrels. About 2-3 billion barrels is within the water-floodable area, and of that, industry can recover about 20 percent by today's methods, he explained.

MR. DUNHAM gave an overview of BP's work in viscous oil over the past 20 years. He said that there are three eras: the Research and Development (R&D) era, the piloting era, and the bigger projects era. The R&D era spanned from the early 1980s to about 1999, during which the industry as a whole spent over a half of a billion dollars. In 1999, BP was able to start testing and doing pilots. In 2000, BP started on bigger projects, such as the [S-Pat project] at Milne Point where BP spent over \$180 million. He remarked that in 2004, BP developed over 30 wells in all three areas of viscous oil: Prudhoe Bay, Kuparuk, and Milne Point. He said that the technology folks at BP want to find a way to develop about \$1.2 billion of capital projects over the next decade, including building facilities and gravel pads.

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REPRESENTATIVE KERTTULA asked what Alaskan contractors BP uses now.

MR. DUNHAM said that BP uses [Doyon Drilling, Inc.], VECO Corporation, [Arctic Slope Regional Corporation Energy Services], NANA/Colt Engineering, LLC, and others.

REPRESENTATIVE KERTTULA asked what percentage of the people employed by those contractors are Alaskan.

MR. DUNHAM replied that he did not know.

REPRESENTATIVE KERTTULA asked what percentage of the employees are in a union.

MR. DUNHAM replied that he did not know.

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MR. DUNHAM discussed what has been developed and produced from the water floodable areas. He referred to a graph that depicts the gross production and the BP net from the 1970s through present day and then makes predictions for the future. He said:

Early on the production was all Milne Point, which was 100 percent BP. And as time went on, we developed projects in Prudhoe Bay and Kuparuk. ... Today we're actually close to 60,000 barrels a day of viscous oil production. ... And all of the fields, Prudhoe, Kuparuk, and Milne Point, are at peak viscous production.... Looking forward, if we can do the projects that we want to do, and they are as successful as we hope, towards the end of the decade we could get up to 100,000 barrels a day gross production. That would be more than 10 percent of the North Slope's production, and on the scale of an Alpine, greater than a North Star.

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CHAIR KOHRING asked if there is viscous oil development anywhere else in the world.

MR. DUNHAM replied:

In some ways we're breaking new ground, but there's a lot of heavy oil. Heavy and viscous are somewhat used interchangeably, but there's a lot of heavy oil throughout the world. Our difference is we're cold, and therefore it brings new challenges. Canada has

[about 2.2 trillion barrels] ... and Venezuela has more than that, maybe by magnitudes of ten to a hundred. Russia has a huge amount. We actually believe that the world has a lot more heavy oil than it really worries about it, because we've been worrying about light oil.... But the world's running out of light oil, and so you start moving to the more difficult things.

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CHAIR KOHRING commented that most of the viscous oil on the North Slope is mixed with sand, and he asked Mr. Dunham to touch on that issue as well as environmental concerns.

MR. DUNHAM passed around a bag of oily soil and said that it's unconsolidated, like beach sand; it's not like a rock, which is what Prudhoe Bay is.

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MR. DUNHAM commented on the importance of having new well designs, such as multilateral wells. He noted that at the Orion field in Prudhoe Bay there is a quadrilateral well, and BP just drilled its first pentalateral well. He said that the projects being developed right now are the West Sak project, which is the biggest viscous oil development on the slope; and the Orion and Polaris in Prudhoe Bay.

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MR. DUNHAM referred to a slide entitled, "Evolution of Heavy Well Design" on page 3 of a handout which showed what the well designs look like. He explained that originally industry used vertical wells, which drilled directly down and "could only perforate or put holes in a very few numbers of feet, and we had very slow oil production, and it oozed into the well bore." Now the industry drills multilateral wells in which it can drill four or five zones out of one well bore as well as drilling laterals, which are drilled horizontally and can be up to a mile and a half to two miles long. He said, "When you add all of these laterals together, you can have more than five miles of the reservoir actually connected to the well bore."

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REPRESENTATIVE GARDNER asked if oil in the traditional wells falls down and prevents seepage from the lower levels.

MR. DUNHAM replied that there are pumps in the wells that lower the pressure and lift the oil to the surface.

CHAIR KOHRING mentioned that he was looking for trips for the House Special Committee on Oil and Gas to go on. He recommended that a trip to the North Slope would be a great learning experience.

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MR. DUNHAM moved on to the challenges industry faces in dealing with viscous oil. He said:

A key thing here is low reservoir temperature, about 80 degrees in the area that we've been exploiting so far. The deeper Prudhoe Bay, Endicott, North Star oil is at 200 degrees." He then used the analogy of maple syrup at different temperatures to explain how oil can be more viscous when it's cold and less viscous when it's hot. He said, "You may hear the term 'API gravity'. ... That is a measure of weight. The real issue about how hard and expensive, and the challenge of this oil is viscosity, and most of it's caused by the temperature. It also makes it very difficult to separate the oil, and the water, and the sand that comes out of the wells. These wells may produce all ... oil the first couple of days, and then water starts coming in more ... with sand.

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MR. DUNHAM continued:

It also brings with it a lot of sand.... You could try and shut off the sand, but then you shut off ... the way the oil can ooze into the well bore. So we have to find ways to deal with the sand. And the sand actually is coming into facilities built for light oil that didn't have this problem. So as we develop new projects, we have to spend money upgrading the facilities.

MR. DUNHAM related a story regarding Prudhoe Bay's shutdown in production in last year in order to get rid of some sand.

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MR. DUNHAM commented that with all of these challenges, it's very expensive to develop [viscous oil]. The multilateral wells cost \$8-9 million each, and the operating costs are also higher. He turned to the top slide on page 4 of the handout entitled, "Regional Schrader Bluff/West Sak Cross Section", which is a side view of a reservoir. The map shows that Polaris is at a depth of about 5,000 feet while Orion and Milne Point are at 3,500 feet, and West Sak is above 3,000 feet, which is very close to the permafrost, and therefore the oil is more viscous there.

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MR. DUNHAM pointed out the picture on the bottom slide of page 4 which reemphasized that viscosity is the issue, not the API gravity. He explained that the units of measurement for viscosity is the centa-Poise (cP). The viscosity of water is 1 cP and, in comparison, some of the oil in the North Slope has a viscosity of up to 10,000 cP. He noted that the oil that BP is currently dealing with has viscosities from 10-50 cP. Then he showed the committee a short film demonstrating how fast the light oil moves compared to the heavy oil.

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CHAIR KOHRING asked how the heavy oil is extracted.

MR. WEST explained that the heavy oil can be pumped out, but for the very viscous oil the [operators] have to add some kind of energy to the reservoir, such as heat or gas.

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MR. DUNHAM showed pictures of an oil dehydrator in Prudhoe Bay that became almost completely filled with sand. He explained that the facility was built for light oil, but as heavy oil is brought in, new equipment such as sand jets need to be added to the facility to get the sand out of the system. He pointed out that the removed sand is taken to an approved grind-and-inject well for disposal, which generally costs about \$150 for each cubic yard of sand.

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MR. WEST commented:

I'm lucky enough to work in an environment where we have a lot of sharing of knowledge between the operators. The operators, ConocoPhillips and BP, and [ExxonMobil Corporation], a non-operator, have probably shown an unprecedented amount of collaboration of technology over the last years. We have three separate teams working the three fields, and ... we've created an environment where each team can learn from the other teams' advances, and that's really spurred technology growth....

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MR. WEST pointed out that BP is also experimenting with different types of artificial lift and how to separate the oil on the surface, as well as enhanced oil recovery (EOR). He said, "We're looking at ways to use the CO2 that will be available in vast quantities once we start selling the gas down the pipeline. We would like to sequester that in the ground, and also use it for enhanced oil recovery." He commented that the oil industry is now able to drill one and a half to two miles, and are able to target the wells within a foot of the target.

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MR. WEST showing the committee a picture of the types of wells that are being drilled in Venezuela called fishbone wells.

MR. DURHAM noted, "There's really only two surface locations coming down, and then they had many wells ... targeting very precise pockets of oil. And they can drill these kind of wells for about a million dollars."

CHAIR KOHRING asked how long this technology had been around.

MR. WEST responded, "Not very long, a couple of years. We're looking at applying this technology in Alaska now."

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MR. DUNHAM stated:

There's a huge amount of this viscous oil in Alaska in place. ... The recovery factors, what you can get out

of the ground, are much lower for viscous than light, and probably always will be. But the goal is to broaden the area where we can get any of it, and find a way to increase the areas we've already developed higher than 20 percent. This is a big resource to BP: we're in all of the viscous oil, we own part of all of it, and are excited about it for us and for the State of Alaska.

MR. DUNHAM summarized the challenge of viscous oil as "thick, cold, and sandy." To unlock the value, there need to be some technology advances, he said, and this will cost a lot of money in R&D, and take a lot of patience.

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REPRESENTATIVE ROKEBERG asked if there is a method for grading viscosity in order to relate it to API gravity.

MR. WEST reiterated that the measurement of viscosity is in cP. He explained that water has a viscosity of 1 cP, olive oil is about 100 cP, and molasses is about 1,000 cP. He said, "We prefer to work in cP because it represents the degree of difficulty of flow. API is rather ... misleading because a certain API oil at different temperatures can have different viscosities."

MR. DUNHAM further clarified:

For example, 19 gravity oil at 10,000 feet might be very hot and have a low viscosity. That same oil, if you brought it up close to the permafrost might not move. ... [Gravity] is measured at 60 degrees Fahrenheit, so it's [an] issue of weight but not of flow, and that's why viscosity is the key thing here.

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REPRESENTATIVE ROKEBERG commented that the gravity would have an influence on the quality of the oil. Regarding the use of CO2 for EOR, he asked, "Is that going to require substantial refitting and additional capital investment? ... How do you handle CO2; isn't that somewhat dangerous ...?"

MR. WEST replied:

The industry's fairly familiar with high CO2-content gas, but it does require refitting of a lot of the surface and down hole facilities. When CO2 is mixed with water, it produces ... [an] acid and that tends to eat away at the steel in the ground and on the surface, so we have to employ stainless steel, [and] plated steel. And that will require substantial investment.

MR. WEST, in response to Representative Rokeberg, stated that a certain amount of the [CO2 used to flood a bore] would come back and be cycled around again.

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CHAIR KOHRING asked how the sands are disposed of and if they pose any environmental problems.

MR. DUNHAM replied:

It's not an environmental problem. We have a place to dispose of it. We literally, currently, take it out of the vessels, and it goes onto trucks which then drive to a ... Prudhoe Bay grind-and-inject facility, where it's actually ground up further and pumped down with water into a reservoir that's permitted to actually these.

MR. DUNHAM said:

I will give you an example of something that happened right before Christmas that shows the impact of this. We had what's called Phase Three conditions on the North Slope, which means no trucks can move and people have to stay inside for safety; can't see, it's 40 below. And the sand pit that holds the sand gets full. ... We actually had to shut in production because we had nowhere to put the sand and we couldn't take the dump trucks to Prudhoe Bay.

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CHAIR KOHRING asked if the current facilities could be used for the viscous oil or if all new facilities would have to be built.

MR. DUNHAM responded that it depends on where the oil is. Some of the current projects are being drilled from existing gravel

pads, he said, but if the oil is in a place where there is no pad, they'd have to build a new one. He said:

And that gets the oil to the surface, and then we need to actually put heat into it, so we build heaters that heat the oil up so it flows to the facilities. Now our current facilities handle both light and heavy oil. As heavy oil becomes a higher percent of the oil up there, more issues of dealing with the mixture will occur. In fact, if we could really unlock this, you could see a day where a facility is built specifically to handle the heavy oil and you only had heavy oil coming into it, so you had certain metals and certain sand handling.

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REPRESENTATIVE SAMUELS asked how much sand there is in light oil.

MR. WEST answered that most of the light oil comes from the consolidated formations, which are deeper and no sand comes up with it.

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REPRESENTATIVE ROKEBERG asked how different the viscosity of the oil from the Orion and Polaris fields are from the oil from Schrader bluff area.

MR. DUNHAM responded that Orion has a sand problem, but because of the deep depth, it is warmer, and therefore the viscosity is lower than West Sak or Kuparuk, but it is still considered heavy oil.

REPRESENTATIVE ROKEBERG asked if Polaris is the same.

MR. DUNHAM replied that Polaris is a separate accumulation but it has the same sand problems because the reservoirs are much shallower than in Prudhoe Bay.

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REPRESENTATIVE ROKEBERG asked if the capital costs are similar to other highly viscous fields.

MR. DUNHAM answered affirmatively and said:

Orion/Polaris is part of this collaboration that's going on between ConocoPhillips, BP, and Exxon in the heavy oil forum, where we're all learning from each other. The developments are ... learning from what's going on at West Sak and Milne because they are the similar types of reservoirs, similar designs of drilling for the wells, the multilaterals, and having to deal with the same facilities. It's even worse because Prudhoe Bay's facilities are older. They were built in the era of the mid-70s and don't ... have quite some of the facilities that Milne and the Kuparuk fields have. So you not only have all of the heavy oil challenges, but you have facilities that were designed in the era before, so there's more facilities upgrades required.

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REPRESENTATIVE ROKEBERG asked what the production was on a per well basis at Polaris, Orion, Schrader Bluff, and West Sak.

MR. WEST replied that the production rates in all those fields are similar. He noted that West Sak and Orion have had some of the highest initial rates, but stabilize rates for all the fields are about 1,000 barrels per day.

MR. DUNHAM remarked, "We've actually designed ... a well-predictive model for all the fields that we use. It's a similar model to predict what the production per well will be."

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MR. WEST, in response to Representative Rokeberg confirmed that most of the well bores are multilateral wells now. He commented that [industry] has not tried steaming techniques, but has instead drilled new multilateral wells and converted the old wells to water injection.

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REPRESENTATIVE ROKEBERG asked if there are any permitted reinjection wells near the fields so that the industry doesn't have to truck the waste sand to the disposal sites.

MR. DUNHAM answered that the Prudhoe Bay grind-and-inject facility is for the disposal of a number of things in a

permitted way and is set up to handle what [BP] used to produce. But, he said:

now that Milne and Kuparuk are producing more viscous and more sand, we are exploring the need for possible other smaller grind-and-inject facilities west of the Kuparuk River, because there's an added problem: the bridges across the river are not accessible all times of the year also, so we don't want production to be stopped because we can't get the trucks over there. We are definitely looking at all kinds of ways to be more efficient from a cost point of view and a handling point of view. It's not good to have people shoveling things, and it's not good for trucks going all over the place. We can do it a more efficient way. We probably will be doing some better projects in the next year to year and a half to fix this issue.

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CHAIR KOHRING announced that he would put together a trip list of the possible locations the committee members could visit. He mentioned a few possible trips, such as riding a tanker from Valdez to Washington, visit the North Slope, visit oil platforms at Cook Inlet, or tour the Valdez terminal.

CHAIR KOHRING mentioned that he would produce a list of legislation that's in the committee. He also noted that the Energy Council will be meeting from March 10-13.

ADJOURNMENT

There being no further business before the committee, the House Special Committee on Oil and Gas meeting was adjourned at [6:08:04 PM](#).